

### 3. OUR RESEARCH AND ITS PLACE IN NASA'S MISSION

The direction of our research effort is influenced by NASA's overall program, outlined in the Agency's strategic plan of 2003, [http://www.nasa.gov/pdf/1968main\\_strategi.pdf](http://www.nasa.gov/pdf/1968main_strategi.pdf). The new vision for space exploration resulted in the transformation of NASA's goals and produced a reorganization of NASA Headquarters and the NASA Centers during 2004. The former seven strategic enterprises have been transformed into four components or mission offices: Exploration Systems, Space Operations, Science, and Aeronautics Research. Following NASA Headquarters, Goddard Space Flight Center has reorganized and formed one Directorate combining Earth and Space Science into the Sciences and Exploration Directorate. The three Divisions under the new Sciences and Exploration Directorate are Earth–Sun Exploration, Solar System Exploration, and Exploration of the Universe. The Laboratory for Atmospheres is under the Earth–Sun Exploration Division (ESED). Our three Branches, Mesoscale Atmospheric Processes, Climate and Radiation, and Atmospheric Chemistry and Dynamics will continue their strong programs of research in Earth Sciences and in this way, will make significant contributions to the President's Exploration Initiative. In October 2005, the Earth–Sun Exploration Division published a strategic plan for the Division outlining the Division's mission and goals in greater detail than the Agency plan <http://webserv.gsfc.nasa.gov/images/esappdocs/ESEDstratplanv2.pdf>. The Laboratory's research is guided by the goals contained in this plan. The remainder of this section outlines the connection of our research to NASA's mission and strategic plans.

The Laboratory for Atmospheres has a long history (40+ years) in Earth Science and Space Science missions studying the atmospheres of Earth and the planets. The wide array of our work reflects this dual history of atmospheric research from:

- (1) the early days of the Television Infrared Observation Satellite (TIROS) and Nimbus satellites with emphasis on ozone, Earth radiation, and weather forecasting; and
- (2) the thermosphere and ionosphere satellites, the Orbiting Geophysical Observatory (OGO), the Explorer missions, and the Pioneer Venus Orbiter, to the more recent Galileo mission, and the current Cassini mission.

A current focus is on global climate change and one goal is to increase the accuracy and lead-time with which we can predict weather and climate change. The Laboratory for Atmospheres conducts basic and applied research in the cross-disciplinary research areas outlined in Table 3.1, and Laboratory scientists focus their efforts on satellite mission planning, instrument development, data analysis, and modeling.

Table 3.1: Science themes and our major research areas.

Science Themes	Major Research Areas
Aerosols	• Aerosols
Atmospheric Chemistry	• Atmospheric Chemistry and Ozone
Carbon Cycle	• Atmospheric Hydrologic Cycle
Climate Change	• Carbon Cycle
Global Water and Energy Cycle	• Clouds and Radiation
Weather and Short-term Climate Forecasting	• Climate Variability and Prediction
	• Mesoscale Processes
	• Precipitation Systems
	• Severe Weather
	• Chemistry-Climate Modeling
	• Global and Regional Climate Modeling
	• Data Assimilation

Our work can be classified into four primary activities or products: measurements, data sets, data analysis, and modeling. Table 3.2 depicts these activities and some of the topics they address.

Table 3.2: Laboratory for Atmospheres science activities.

Measurements	Data Sets	Data Analysis	Modeling
Aircraft	Assimilated products	Aerosol cloud climate interaction	Atmospheric chemistry
Balloon	Global precipitation	Aerosol	Clouds and mesoscale
Field campaigns	MODIS cloud and aerosol	Atmospheric hydrologic cycle	Coupled climate–ocean
Ground	TOMS aerosol	Climate variability and climate change	Data assimilation
Space	TOMS surface UV	Clouds and precipitation	Data retrievals
	TOMS total ozone	Global temperature trends	General circulation
	TOVS Pathfinder	Ozone and trace gases	Radiative transfer
	TRMM Global precipitation products	Radiation	Transport models
	TRMM validation products	UV-B measurements	Weather and climate
		Validation studies	

- a. Moderate Resolution Imaging Spectroradiometer
- b. TIROS Operational Vertical Sounder
- c. Tropical Rainfall Measuring Mission
- d. Ultraviolet-B

Classification in the four major activity areas: measurements, data sets, data analysis, and modeling, is somewhat artificial, in that the activities are strongly interlinked and cut across science priorities and the organizational structure of the Laboratory. The grouping corresponds to the natural processes of carrying out scientific research: ask the scientific question, identify the variables needed to answer it, conceive the best instrument to measure the variables, generate data sets, analyze the data, model the data, and ask the next question.